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(54) **Crisp edible material and method of preparing same.**

(57) Crisp edible material predominantly comprising 40 to 70% pure gluten protein and starch having an amylopectin to amylose ratio ranging from 8:1 to 25:1.

A method of preparing an expanded crisp food material by extruding a mixture of predominantly 40 to 70% of pure gluten protein and 30 to 60% of starch having an amylopectin to amylose ratio of from 8:1 to 25:1 and up to 30 parts water per 100 parts solids at temperatures between 100 and 150°C and drying the extrudate.

**EP 0 565 386 A1**

Crumbed food products, ie food products having a bread crumb coating, are known in a great variety and are both prepared in the kitchen for direct consumption and in the food industry for frozen or chilled storage and distribution.

Generally accepted texture requirements for crumbing materials being light, not too hard and simultaneously crisp, which properties should be little or not influenced by usual humidity conditions prevailing during usual storage and shipping.

It is an object of the invention to provide crisp edible material showing a combination of the above properties as well as a method of preparing this material.

The invention provides thereto a crisp edible material predominantly comprising gluten and starch, comprising amylopectin and amylose, which is characterized in that the pure gluten protein content ranges from 70% to 40% and the ratio of amylopectin to amylose ranges from 8:1 to 25:1. In a preferred embodiment the pure gluten protein content ranges from 45 to 62%. In a particularly preferred embodiment the ratio of amylopectin to amylose ranges from 9:1 to 23:1. These embodiments are particularly preferred because of the longer keepability under high humidity conditions. This effect and these properties are particularly advantageous for use with expanded material as crumbing material usually is.

In this specification and claims percentages and parts are related to weights, unless otherwise indicated.

The term "gluten" in practice is ambiguous: "commercial gluten" is a product containing about one tenth starch, the bulk i. e. roughly three quarters, being a proteinaceous product or "pure gluten protein", the balance being lipid and water. Analysis of one commercial sample being as follows: gluten protein 77%, starch 9%, lipid 6% and water 7%. For clarity the expressions "commercial gluten" and "pure gluten protein" are used throughout this specification and claims.

For preparing crumbs several processes are in use at the moment, the best known being; preparing a dough, allowing this to be blended with any leavening agent, then baking, drying and comminuting or extruding a low moisture mixture of the aforementioned dough at increased temperature and pressure, also known as cooker-extruding, drying and comminuting.

Unexpectedly an expanded food material of acceptable hardness and a high crispiness which can fairly survive usual humidity conditions can be prepared by extruding a mixture of predominantly 40 to 70% of pure gluten protein and 30 to 60% of starch having an amylopectin to amylose ratio of from 8:1 to 25:1 and up to 30 parts water per 100 parts solids, although 20 parts or less is preferred, at elevated temperatures between 100 and 150°C and in particular between 120 and 140°C and drying the extrudate. Drying is preferably effected using a gas, e.g. warm air, having a temperature not exceeding 70°C. The above preferred conditions all contribute to obtaining a less hard, crispier and better moisture resisting product. For manufacturing crumbs the product so obtained can be comminuted to the desired particle size.

The invention will be exemplified in the following examples of some at this moment preferred embodiments (Examples XIII, I and IV) and some comparative compositions (Examples XII, XIV, XV, II, III, V, VI, VII, VIII, IX, X, XI).

#### Example I

70 parts commercial gluten containing 9% wheat starch, 30 parts waxy maize starch (1% amylose and 90% amylopectin) and 20 parts total water (including water in gluten and starch) were fed into a "Clextrel" cooker-extruder driven at approximately 175 revs/min. Inside the extruder a temperature developed of between 125 and 135°C. On emerging through a nozzle having a single extrusion opening of approximately 8mm the dough expanded by 50 to 100% and set. After drying for not less than half an hour using hot air of 50-70°C the extrudate was milled.

#### Example II to XV

The process of example I was repeated, using different compositions as summarized in table A.

#### Evaluation

The products as enlisted in table A were tested for hardness/crispness immediately after cooling down to room temperature using a trained test panel, distinguishing between H = hard and unacceptable, C = crisp, H/C = a bit in between but still just acceptable and T = tough.

Also the products were tested for moisture resistance by equilibrating in environments of different relative humidity. After equilibration the moisture content of the product was determined and also the brittleness properties by determining the acoustic emission using a Locan® analyzer when fracturing the product and express-

ing this as a percentage of the acoustic emission when fracturing the freshly prepared product. The results of these tests are summarized in Table B.

For both the panel test and the acoustic emission determination the particle size for the crumb was from 2.4 to 2.8mm.

In this table the following expressions are used:

CGL = commercial gluten (comprising 9% wheat starch 77%, protein, 6% lipid and 7% moisture)

WMS = waxy maize starch (1% amylose + 90% amylopectin and about 10% moisture)

WS = wheat starch (24% amylose, 67% amylopectin and 9% moisture)

texture = texture defined by an experienced consumer testing group

C = crisp

H = hard

C/H = partly crisp/partly hard

T = tough

RH = relative humidity %

brittleness = measured by acoustic emission in % of the emission of the fresh prepared product at 0% relative humidity.

TABLE A

Example	COMPOSITION			Pure Gluten Protein	Amylose	Amylo- pectin	RATIO Amylopectin:Amylose
	CGL	WMS	WS				
XII	100	--	--	77	2.1	6.0	2.9:1
XIII	80	20	--	62	1.9	22.8	12.0:1
XIV	80	10	10	62	4.2	20.5	4.9:1
XV	80	--	20	62	6.5	18.2	2.8:1
I	70	30	--	54	1.77	31.2	17.6:1
II	70	15	15	54	5.24	27.8	5.3:1
III	70	--	30	54	8.7	24.3	2.8:1
IV	60	40	--	46	1.62	39.7	24.4:1
V	60	20	20	46	6.24	35.0	5.6:1
VI	60	--	40	46	10.86	30.4	2.8:1
VII	40	60	--	31	1.38	56.4	40.9:1
VIII	40	30	30	31	8.31	49.5	5.6:1
IX	40	--	60	31	15.24	42.6	2.8:1
X	--	100	--	--	0.9	90	100:1
XI	--	--	100	--	24	67	2.8:1

TABLE B

Example	ACOUSTIC EMISSION (%)					MOISTURE CONTENT (%)					TEXTURE AT 0% RH
	0	33	57	69	75	0	33	57	69	58	
RH											
XII	100	98	98	84	9	1.9	6.1	8.3	9.3	11.7	H
XIII	100	--	93	--	3	2.6	--	9.7	--	12.4	C/H
XIV	100	--	30	--	1	2.1	--	9.7	--	12.6	C/H
XV	100	--	48	--	2	2.7	--	10.1	--	12.8	C/H
I	100	80	84	52	1	1.6	8.2	9.7	10.4	12.5	C
II	100	94	53	22	1	1.7	7.9	10.9	10.5	--	C
III	100	64	9	1	0	1.6	9.1	10.8	11.5	--	C
IV	100	87	80	43	1	1.5	7.9	9.7	10.8	11.5	C
V	100	93	42	14	1	1.6	7.1	9.3	10.2	12.5	C
VI	100	96	7	2	0	1.5	8.9	10.7	11.3	13.1	C
VII	100	89	36	12	1	2.6	8.9	11.2	11.6	13.6	C
VIII	100	--	50	--	3	3.1	--	10.5	--	12.8	C
IX	100	70	10	5	1	2.6	8.6	10.8	11.0	13.1	C
X	100	86	9	4	0	2.1	9.2	12.7	13.4	14.8	T
XI	100	35	3	2	1	2.2	9.0	11.7	12.2	14.2	T

## Claims

- 5 1. Crisp edible material predominantly comprising gluten and starch including amylopectin and amylose characterised in that the pure gluten protein content ranges from 70% to 40% and the ratio of amylopectin to amylose ranges from 8:1 to 25:1.
2. Material according to claim 1 characterised in that the pure gluten protein content ranges from 45 to 62%.
- 10 3. Material according to claim 1 or claim 2, characterised in that the ratio of amylopectin to amylose ranges from 9:1 to 23:1.
4. Material according to any one of claims 1 to 3, characterised in that the material is expanded.
- 15 5. A method of preparing an expanded food material comprising extruding a mixture mainly consisting of starch and gluten in the presence of water at elevated temperature, characterised in that predominantly 40 to 70% of pure gluten protein and 30 to 60% of starch having an amylopectin to amylose ratio ranging from 8:1 to 25:1 is mixed together with up to 30 parts water per 100 parts solids and extruded at a temperature between 100 and 150°C.
- 20 6. The method of claim 5 characterised in that the mixture is extruded at a temperature between 120 and 140°C.
7. The method of claim 5 or 6 characterised in that up to 20 parts water per 100 parts solids are used.
- 25 8. The method of claim 5, 6 or 7, characterised in that the starch is predominantly waxy maize or waxy rice starch.
9. The method of any one of claims 5 to 8, characterised in that the expanded material after extrusion is dried using a gas having a temperature not exceeding 70°C.

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# EUROPEAN SEARCH REPORT

Application Number

EP 93 30 2821

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	EP-A-0 319 287 (UNILEVER) * claims 1-3,7-10 * * page 1, line 34 - page 4, line 10 * * example 8 *	1,2,5,9	A23L1/176 A23L1/0522 A23J3/18 A23P1/14
A	GB-A-1 306 384 (NATIONAL STARCH AND CHEMICAL CO.) * claims 1,8-14 * * page 1, line 54 - page 2, line 18 * * page 4, line 14 - line 29 *	1,3,5,8	
A	FR-A-2 095 138 (THE QUAKER OATS CO.) * claims 1,6 * * page 1, line 30 - page 2, line 21 * * page 5, line 6 - line 33 * * page 6, line 29 - line 37 *	1,2,5,7,8	
A	US-A-3 259 503 (C.T. TAN) * claims 1-3 * * column 1, line 23 - line 65 *	1,5	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			A23L A23J A23P
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 08 JULY 1993	Examiner VUILLAMY V.M.L.
<p><b>CATEGORY OF CITED DOCUMENTS</b></p> <p>X : particularly relevant if taken alone  Y : particularly relevant if combined with another document of the same category  A : technological background  O : non-written disclosure  P : intermediate document</p> <p>T : theory or principle underlying the invention  E : earlier patent document, but published on, or after the filing date  D : document cited in the application  L : document cited for other reasons  &amp; : member of the same patent family, corresponding document</p>			

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